SOUTH CAROLINA Energy Office

Energy Briefs

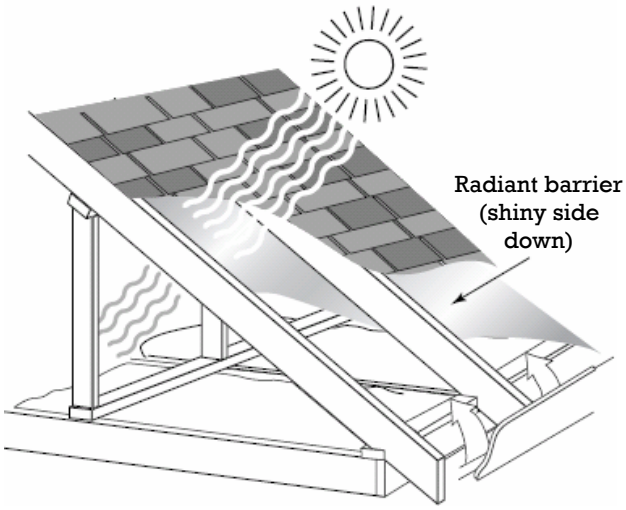
Helping You Live Energy Efficiently!

Radiant Barriers

On a sunny summer day, the temperature of the roof of a house can climb above 140°F. The hot roof radiates heat across the attic air space to the insulation below. As the temperature of the insulation increases, more heat is conducted through the ceiling into the home. Placing a radiant heat barrier, usually aluminum foil coated to a reinforcing material, in the attic can block the flow of radiant heat from the roof to the ceiling. The Florida Solar Energy Center (FSEC) estimates that roughly 20% of the cooling load for a typical Sunbelt home comes from heat gain through the roof. A radiant barrier can stop some of this heat gain.

The Savings

In field tests conducted in the Southeast, savings on cooling costs provided by radiant barriers have ranged from under 5 percent to about 25 percent. Most energy experts feel that *an estimate of 5 to 15 percent savings on cooling is realistic*. If your total air conditioning bill was $500, you could expect to save between $25 and $75 each summer. These estimates generally assume R-19 ceiling insulation. Savings would be less for homes with greater levels of insulation.



Radiant barrier installed to rafters

How It Works

Understanding how a radiant barrier works is important in evaluating its use. When radiant heat strikes the surface of most materials, it is absorbed. Even light-colored surfaces which reflect visible light, such as white paint, absorb radiant heat.

Objects that absorb radiant heat also readily emit it as their temperature increases. Color also has little bearing on how much radiant heat a hot surface emits. A white wood stove radiates heat about as well as a black one.

Materials that reflect radiant heat do not emit it when they increase in temperature. For example, a shiny metal stovepipe gets hot, but does not radiate heat from its surface nearly as well as the stove body.

Radiant barrier products are usually rated by their reflectivity (how much radiant heat they reflect) and their emissivity (how much heat they radiate or emit from their surface). For opaque products like aluminum foil, the sum of the reflectivity and emissivity ratings equals one. Most radiant barrier products have an emissivity rating of 0.05 or less, and conversely a reflectivity rating of 0.95 or greater.

This ability to both reflect radiant heat and to not emit it from its surface when its temperature increases, is how radiant barriers can help lower your utility bills. If the foil is laid on top of the ceiling insulation, it will reflect the radiant heat from the roof that strikes its surface. Likewise, if the foil is stapled to the underside of the roof or along the rafters, with the shiny side facing down, it will not emit radiant heat from its surface.

Installation

Laying a radiant barrier on top of the ceiling insulation saves the most energy initially. However, most energy experts feel that dust over time will settle on the radiant barrier if it is laying flat in the attic

South Carolina Energy Office * 1201 Main Street, Suite 430 * Columbia, SC 29201
(803) 737-8030 * 1-800-851-8899 * Fax (803) 737-9846 * www.energy.sc.gov

and cut its performance substantially. Placing the radiant barrier on top of the ceiling insulation has the potential to trap moisture in the insulation. Even though many products are perforated, there is doubt as to how many holes are needed per square foot to allow moisture to pass. There is also concern as to whether the perforations will stay clear of debris and if moisture may decrease their effectiveness.

The advantage to placing the radiant barrier on top of the insulation is that it is easy to do, and at this location it will help keep heat from inside the house in winter from escaping. Savings on heating bills are much less documented than for cooling, but most experts feel it will save under 10 percent. Many do not feel the modest winter savings are worth the risk of moisture problems or the likelihood of dust accumulation, which could eliminate any savings. In fact several radiant barrier companies, as well as the Reflective Insulation Manufacturers Association (RIMA), warn against installations on top of ceiling insulation.

Stapling the radiant barrier to the rafters or roof decking with the shiny side down takes more time and requires more material than installing it on top of the ceiling insulation, but dust should be much less of a factor at this location. There should also be little worry about trapping moisture. The major concern with attaching the foil to the decking or rafters is the effect of the reflected heat on the life of the roof. The studies done in the Southeast indicate that the roof temperature does not increase significantly, usually only 5 to 10 degrees. It is always wise to check with shingle manufacturers to ensure that their product warranty will not be affected by the installation of a radiant barrier.

One critical point in installing a radiant barrier for any location is that the shiny surface must face an air space for the product to work at all. This air space should be at least an inch deep. Placing the reflective surface directly against a material with no air space eliminates any energy savings.

Products

There are a variety of radiant barrier products on the market. Most use aluminum foil with some type of backing material, such as kraft paper or mylar, to provide strength to the foil. Some products have foil on two sides while others only on one. For most applications, the single-sided foil products perform comparably to the double-sided, so cost is usually the determining factor. There are also products that use "bubble pack" as a backing. Remember, it is the foil that provides the energy savings, though, not the backing material.

Buying a radiant barrier is getting easier for the homeowner, as many companies are marketing the product in the Southeast. A survey conducted by the Southface Energy Institute found material prices ranging from $.06 per square foot to over $.70 per sq. ft. All the products surveyed had comparable emissivity ratings. The economics of installing a radiant barrier need to be compared not only to its potential energy savings, but also to the cost of increasing ceiling insulation levels. Adding an additional R-11 to a R-19 ceiling may be a better investment for much of the Southeast.